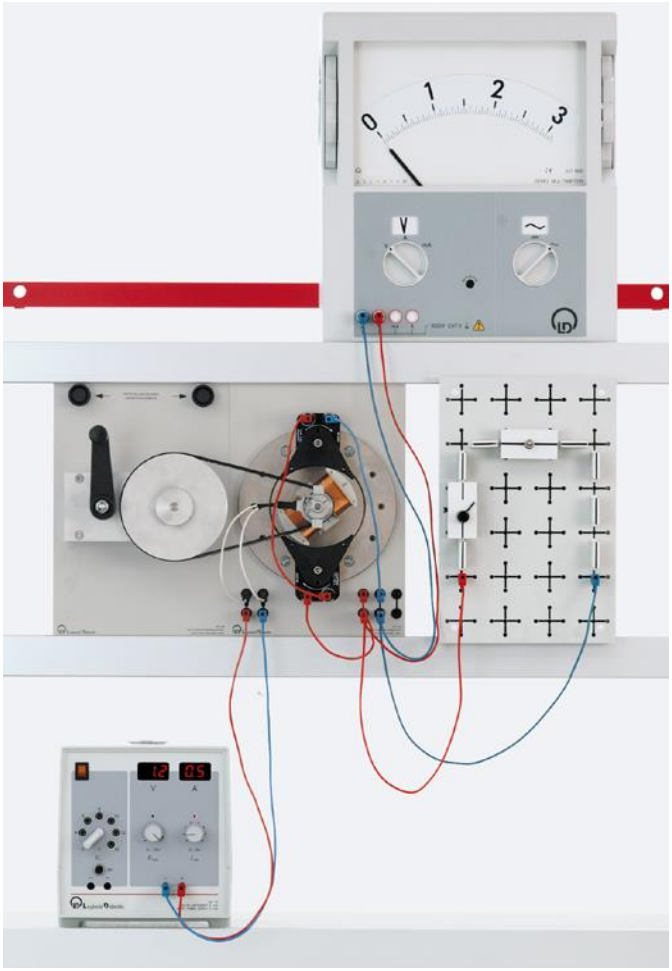
Stationary armature generators under load
Measurement of voltage using a demo multimeter

Objects of the experiment

1. Investigate how the induced voltage depends on load
2. Demonstrate generation of a constant alternating voltage by increasing the rotor current

Setup



Apparatus

1 Basic machine unit	727 81
1 ELM hand-cranked gear	563 303
1 ELM two-pole rotor	563 22
1 ELM brush holder rack	563 18
2 ELM brushes	563 13
2 ELM wide pole pieces for coils	563 101
2 ELM coils, 250 windings	563 11
1 Lamp holder (screw-fitting), E10, top, STE 2/50	582 70
1 Set of 10 bulbs, 3.5 V/0.2 A, E10	505 12
1 Toggle switch, STE 2/50	582 79
1 Set of 10 bridging plugs, STE 2/19	501 48
1 Plug-in board, DIN A4, STE	576 74
1 ELM centring disc	563 17
1 Allen key	563 16
1 Demo multimeters, passive	531 905
1 AC/DC power supply, 0…15 V/0…5 A	521 50
1 Connecting lead, 19 A, 25 cm, red	500 411
2 Pair of connecting leads, 19 A, 25 cm, red/blue	501 44
2 Pair of connecting leads, 19 A, 50 cm, red/blue	501 45
1 Demonstration panel frame	301 300
1 Plug-in board holder, STE	301 320
2 Equipment shelves	301 310
1 Profile rail	301 311
2 Bench clamps with pin	301 05

Procedure

1. Investigate how the induced voltage depends on load:
   - Select a measuring range of 3 V (AC) in the demo-multimeter.
   - Place the brushes in contact with the slip rings of the rotor and connect them to the DC output of the power supply.
   - Use the power supply as a constant current source. To do this, turn the voltage limiting knob to its maximum.
   - Set the current *I* to about 0.5 A.
   - Turn the crank to set the rotor moving at a uniform speed and read off the induced voltage V from the demo-multimeter.
   - With the rotor turning at constant speed, use the toggle switch to switch the lamp into the circuit and read off the induced voltage from the demo-multimeter once again.
2. Generating a constant AC voltage:
   - Set the rotor current to 0.8 A and select a measuring range of 3 V (AC) on the demo-multimeter.
   - Turn the crank to set the rotor moving at a uniform speed and read off the induced voltage *U* from the demo-multimeter.
   - Use the toggle switch to switch the lamp into the circuit and read off the voltage *U* from the demo-multimeter once again.
   - Increase the rotor current from the power supply until the output voltage *U* (induced voltage with no load) is displayed once again

Measuring example

1. Dependence on load:

Load	*Induced voltage *U* in V
None	2.3
Lamp	1.8

*For near-uniform rotation of the rotor and a rotor current *I* = 0.5 A:

2. Generating a constant AC voltage:

Load	Rotor current *I* in A	*Induced voltage *U* in V
None	0.8	2
Lamp	0.8	1
Lamp	1.5	2

* For near-uniform rotation of the rotor

Evaluation

If a stationary armature generator is loaded, the voltage induced in the stator coils decreases if the speed of the rotor remains the same.

If the amplitude and frequency of the generated AC voltage are to remain constant (e.g. as in a power station generator), the rotor current can be increased depending on the load without changing the speed.

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